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Date: January 19, 2007

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Applicant(s): Cyrus E. Tabery *et al.*

Serial No: 09/955,517

Filing Date: September 18, 2001

Examiner: Ram N. Kackar

Art Unit: 1763

Title: *IN-SITU OR EX-SITU PROFILE MONITORING OF PHASE OPENINGS ON ALTERNATING PHASE SHIFTING MASKS BY SCATTEROMETRY*

**Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450**

REPLY BRIEF

Dear Sir:

Appellants' representative submits this Reply Brief in response to the Examiner's Answer dated November 24, 2006. A credit card payment form is submitted concurrently herewith, wherein the credit card payment is believed to cover all fees due regarding this document. In the event any additional fees may be due and/or are not covered by the credit card, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1063 [AMDP753US].

A. Regarding the rejection of Claims 1, 2, 4, 5, 9-12, 25 and 26 Under 35 U.S.C. §102(e)

Claims 1, 2, 4, 5, 9-12, 25 and 26 stand rejected as anticipated under 35 U.S.C. §102(e) over Subramanian *et al.* (US Patent 6,562,248 B1). Reversal of this rejection is requested for at least the following reasons. Subramanian *et al.* does not anticipate each and every element as set forth in the subject claims.

Appellants' claimed invention relates to a system that facilitates monitoring, measuring and/or controlling the fabrication of apertures in alternating aperture phase shift masks employed in semiconductor manufacturing. Independent claims 1, 25 and 26 recite similar limitations, namely: *a system that measures an etch of a mask feature, comprising, one or more mask creating components...; a driving component that controls the one or more mask creating components; an emitting component...; and an analysis component that measures one or more feature parameters based on a light reflected and/or refracted from the one or more features via a scatterometry system, the measured feature parameters utilized by the driving component to control the mask creating component during fabrication process to improve the fabrication process of the alternating aperture phase shift mask and during post-fabrication process to improve quality control in the alternating aperture phase shift mask.* Subramanian *et al.* does not expressly or inherently disclose the aforementioned novel aspects of appellants' invention as recited in the subject claims.

More particularly, Subramanian *et al.* does not disclose or suggest an analysis component that measures one or more feature parameters, *the measured feature parameters utilized by the driving component to control the mask creating component during fabrication process to improve the fabrication process of the alternating aperture phase shift mask and during post-fabrication process to improve quality control in the alternating aperture phase shift mask*, as recited in independent claim 1.

Subramanian *et al.* discloses a system for monitoring and controlling aperture etching in a *complimentary phase shift mask*. The system includes one or more etching components operative to etch portions of a mask; an etching component driving system; a system for directing light onto the apertures; a measuring system for measuring aperture parameters; a scatterometry system for processing the light reflected from the apertures; and a processor for receiving aperture data and mapping the mask into a plurality of grid blocks. (See Col. 15, lines

15-40). Subramanian *et al.* does not expressly or inherently disclose a system that facilitates the fabrication of apertures in an alternating aperture phase shift mask, but is instead limited to a system that controls the fabrication of aperture etching in a complimentary phase shift mask.

In response to appellants' representative's assertion that Subramanian *et al.* fails to disclose ***the fabrication of aperture etching in an alternating aperture phase shift mask***, the Examiner contends that the essential requirements for the process of fabricating an alternating phase shift mask and a complimentary phase shift mask are the same. (See Examiner's Answer dated 11-24-06, pg. 6). Appellants' representative respectfully disagrees. A complimentary phase shift mask is created by a two-step masking process, a phase shifting masking operation and a second masking operation. (See Col. 2, lines 54-67 and Col. 3, lines 1-10).

Unlike the complimentary phase shift mask, an alternating aperture phase shift mask is created by a one-step masking process. Typically, transparent films are deposited over the desired transparent areas using a second level lithography and etch technique or vertical trenches are etched directly in the substrate. Accordingly, the one or more mask creating components that fabricate the features on the alternating aperture phase shift mask and the analysis component that measures the features of the alternating aperture phase shift mask would not be the same as the mask creating components and analysis components for a complimentary phase shift mask, as one uses a two-step process and the other a one-step process that etches directly on the substrate. Thus, Subramanian *et al.* is silent regarding a system that facilitates monitoring, measuring and/or controlling the fabrication of apertures in ***alternating aperture phase shift masks***.

Furthermore, Subramanian *et al.* does not disclose the *in-situ* and *ex-situ* monitoring and control of features of an alternating aperture phase shift mask. Appellants' system for measuring, monitoring and/or controlling alternating aperture phase shift mask fabrication can be employed *in-situ* (e.g. during fabrication) to control the fabrication of the mask and/or can be employed *ex-situ* (e.g. post-fabrication) in processes like quality control. (See pg. 12, lines 23-32). The *in-situ* and *ex-situ* process is tied to specific structure, as the measuring, monitoring and controlling fabrication *in-situ* and *ex-situ* would not be done on a complimentary phase shift mask that requires a two-step process. Specifically, appellants' system includes using etching components to etch apertures and/or gratings in the mask, determining the acceptability of the apertures and/or gratings etched in the mask and using *in-situ* coordinating control of the etching

components to more optimally etch the apertures in the mask and/or *ex-situ* monitoring to determine whether an acceptable mask has been fabricated. (See pg. 9, lines 5-11). The system provides an analysis component that measures one or more feature parameters, the measured feature parameters are then utilized by the driving component to control the mask creating component for fabricating one or more features on an alternating aperture phase shift mask.

In contrast, the system of Subramanian *et al.* includes a measurement component to measure the shape, depth and/or width of the apertures in the mask, a detection component for detecting the reflected light, and a control system to configure and control operation of the etching system for a two-step process. (See col. 7, lines 31-48). Thus, Subramanian *et al.* is silent with regard to a system for measuring and fabricating features on an alternating aperture phase shift mask, and *selectively controlling the etching of one or more apertures based on analysis of data collected and employing the analysis of data in-situ to control fabrication of the alternating aperture phase shift mask and ex-situ to improve quality control in the alternating aperture phase shift mask.*

In view of at least the foregoing, it is readily apparent that Subramanian *et al.* does not anticipate or suggest the subject invention as recited in claims 1, 25 and 26 (and claims 2, 4-5 and 9-12 which respectively depend there from). Accordingly, this rejection should be reversed.

B. Conclusion

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of claims 1, 2, 4, 5, 9-12, 25 and 26 be reversed.

If any additional fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063 [AMDP753US].

Respectfully submitted,
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